## ARTIFACT SHEET

Enter artifact number below. Artifact number is application number + artifact type code (see list below) + sequential letter (A, B, C). The first artifact folder for an artifact type receives the letter A, the second B, etc	
Examples: 59123456PA, 59123456PB, 59123456ZA, 59123456ZB	
Example	100/4563 BA
Indicate quantity of a single type of artifact received but not scanned. Create individual artifact folder/box and artifact number for each Artifact Type.	
	CD(s) containing:  computer program listing  Doc Code: Computer  Artifact Type Code: P
	pages of specification and/or sequence listing and/or table
	Doc Code: Artifact Artifact Type Code: S  content unspecified or combined  Doc Code: Artifact Artifact Type Code: U
	Stapled Set(s) Color Documents or B/W Photographs Doc Code: Artifact Type Code: C
	Microfilm(s)  Doc Code: Artifact Type Code: F
	Video tape(s)  Doc Code: Artifact
	Model(s)  Doc Code: Artifact Type Code: M
	Bound Document(s)  Doc Code: Artifact Type Code: B
	Confidential Information Disclosure Statement or Other Documents marked Proprietary, Trade Secrets, Subject to Protective Order, Material Submitted under MPEP 724.02, etc.  Doc Code: Artifact Type Code X
	Other, description:  Doc Code: Artifact Type Code: Z



# United States Patent [19]

Floyd et al.

[11] Patent Number:

6,002,507

[45] Date of Patent:

Dec. 14, 1999

## [54] METHOD AND APPARATUS FOR AN INTEGRATED LASER BEAM SCANNER

[75] Inventors: Philip D. Floyd; Decai Sun, both of Sunnyvale, Calif.; Joel A. Kubby,

Rochester, N.Y.

[73] Assignee: Xerox Corpoation, Stamford, Conn.

[21] Appl. No.: 09/201,738

[22] Filed: Dec. 1, 1998

[51] Int. Cl.<sup>6</sup> ...... G02B 26/08

[52] U.S. Cl. ...... 359/201; 359/850; 359/224

224, 225; 250/230, 234

#### [56] References Cited

#### U.S. PATENT DOCUMENTS

Daneman, M.J.; Solgaard, O.; Tien, N.C.; Lau, K.Y.; Muller, R.S. "Laser-to-Fiber Coupling Module Using a Micromachined Alignment Mirror." *IEEE Photonics Technology Letters*, vol. 8, No. 3, Mar. 1996, pp. 396–398.

OTHER PUBLICATIONS

Judy, J.W.; Muller, R.S. "Batch-Fabricated, Addressable, Magnetically Actuated Microstructures." *Solid-State Sensorand Actuator Workshop*, Hilton Head, South Carolina, Jun. 2-6, 1996, pp. 187-190.

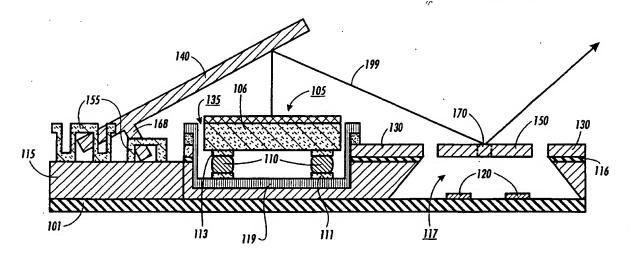
Lin, L.Y.; Lee, S.S.; Pister, K.S.J.; Wu, M.C. "Self-aligned hybrid integration of semiconductor lasers with micromachined micro-optics for optoelectronic packaging." *Appl. Phys. Lett.* 66 (22), May 29, 1995, ©1995 American Institute of Physics, pp. 2946–2948.

Primary Examiner—Cassandra Spyrou Assistant Examiner—Leo Boutsikaris

#### [57] ABSTRACT

A solid state laser beam scanning system having a single crystal silicon deflection and scanning mirror integrated with a laser diode. By combining the techniques of deep reactive ion etching of silicon with solder bump bonding techniques, completed and tested laser diodes are integrated with silicon substrates supporting micro-electro-mechanical systems layers.

#### 20 Claims, 11 Drawing Sheets



6,002,507 The United States America

# The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

### **United States Patent**

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.

Wood John

Commissioner of Patents and Trademarks

Mayorie V. Jurner